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Two Methods for Estimating Soviet Military Production

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¹I wish to thank David Epstein, Viktor Polterovich and Arnold Raphaelson for helpful comments and suggestions.

Introduction

Despite an apparent reduction in Soviet military threat, the mystery of Soviet military spending is as exciting as ever. Several factors are responsible for continued interest. To begin with, the Soviet government's confession that it lied in the past spurred curiosity in whether the truth has finally been revealed. Furthermore, the new phenomenon of Soviet writers' exercising independent judgement has already led to numerous challenges of the government's account of their military spending. Westerners' attitudes have also changed. A sign of good taste in comparative economic systems was to obtain estimates of Soviet economic indicators, including military spending, that would not contradict the official Soviet ones too much. Since *glasnost* effectively destroyed the division of Sovietology along the lines of "progressive" and "reactionary" attitudes, being too critical of the Soviets does not damage one's reputation in academia any longer. On the contrary, with ideological constraints removed, a greater deviation from the standards acceptable in the past may even become a sign of originality. Using an analogy from physics, in the past Soviet official estimates attracted those obtained independently, and now there is an effect of repelling between the two.

This paper is concerned with Soviet military production, the largest component of military expenditure. The well known approaches to the problem are based either on direct estimation of physical output and prices of military goods or on some type of aggregate residual estimation. Direct estimation has been used by U.S. intelligence sources; residual estimation is used by those who lack the technical means of gathering intelligence. The methods in this paper fall into the category of the residual approach. The approach could generally be pursued in the broader framework of the GNP accounts or in the narrower framework of the machine-building and metalworking (MBMW) complex.¹ In both cases the estimated activities of civilian

production are subtracted from the overall output values, with the difference identified with military production.

The paper offers two methods for estimating Soviet military production. The first, which I call a direct residual approach, is designed along the traditional lines of estimating civilian MBMW activities. But, unlike the previous attempts, it uses reliable information on outputs of Soviet civilian MBMW ministries. The second method, which I call a verifiable residual approach, uses Soviet statistics generated during the mandatory certification of goods quality. These statistics allow the computation of the output of military goods combined with certain civilian goods that are identified below. The estimation of military production is then reduced to estimating the size of those "impurities" in the combined output. The method is in principle verifiable since the required information is open and exists in Soviet statistics, even though it may not be easily accessible. The two methods are in sections 1 and 2, respectively.

1. Direct Residual Approach

A direct residual approach is based on the computation of the output of the civilian MBMW ministries and on its comparison with the total MBMW output which, as will be shown below, includes the bulk of military production. Before the introduction of the computation results, some methodological clarification would be helpful. The question is: Where is the military industrial complex (MIC) production accounted for in Soviet statistics? Western analysts as well as Soviet economists from academia who are not given access to planning information have been puzzled by the issue.

The Soviets use too many miscellaneous (*prochie*) items in their statistical tables which, some analysts believe, could be identified with military production and expenditure. Under

conditions of secrecy it makes sense to look suspiciously at unspecified items. For example, Birman is doubtful whether the MBMW output accounts for MIC production.² He thus raises a hypothesis that MIC output is a part of a miscellaneous residual of the breakdown of Soviet industrial output. For 1988 the residual was equal to 15.6%; the percentage has to account for the share of metallurgy which at that time was not explicitly stated (9.3% according to the 1989 *Narkhoz*, p.336) and, following the hypothesis, the MIC. This small percentage, as Birman logically indicates, is hard to believe. So where is the MIC production?

Let us consider the MIC ministries, the MBMW complex and industrial production as a whole in an attempt to shed light on the issue. To begin with, we cannot simply assume that the Soviets use miscellaneous items as a mere euphemism for military production. The planners are more sophisticated than that. To assume that they deliberately drop or disperse military production among different items where it does not belong would also be wrong, for Soviet planning has its internal logic. The dispersion which does occur reflects certain principles of classification and accounting which are then kept secret. Therefore, even the notorious 20 b.r. reported as annual military expenditure before 1989 has an explanation. Technically, that was the budget of the Ministry of Defense (MOD). In accordance with the targeted (*tselevoi*) character of the national economic plan, money for the production of military goods, construction, and research and development was appropriated directly to ministries, not to the MOD. The MOD's procurement functions were limited to insisting that the required goods are in the national production plan and to providing a variety of control functions in the production process. Military goods were thus classified on the basis of the producing ministry's affiliation, and, as I will show later, most of them are affiliated with the MBMW complex.

Administratively, there are 9 ministries and 1 committee associated with the MIC: the Ministries of the Aviation Industry (*Minaviaprom*), General Machinery (*Minobshchemash*), Defense Industry (*Minoboronprom*), Radio Industry (*Minradioprom*), Electronic Industry (*Minelektronprom*), Shipbuilding Industry (*Minsudprom*), Communications (*Minsviazi*), Atomic Energy Industry (*Minatomenergoprom*), Civil Aviation, and the State Committee on Computers and Informatics. Although the MIC production is not reported in Soviet statistics, it is imperceptibly included in the MBMW output. A big gap between the MBMW total and its civilian ministries' outputs is a clear demonstration. An even more direct demonstration follows from the classification of the MBMW complex which includes, along with civilian industries, aviation production, general machinery, the defense industry, the radio industry, the electronics industry and shipbuilding.³ I will call those relevant ministries the military MBMW ministries.

Some MIC activities are not accounted for in the MBMW complex. Thus, the Ministry of Civil Aviation and the State Committee on Computers and Informatics are not included in that complex since their primary activity is not production but repair, maintenance and services to industrial users and the population. Some of their activities will be included in the MBMW total (e.g., repair). But most others will only count outside of the complex, dispersed among the industry's total, business transportation (reported as productive), consumer transportation (unproductive), and services to industrial enterprises (productive) and consumers (both productive and unproductive). *Minatomenergoprom* is in part a MBMW ministry (the former *Minsredmash*) and, in part, an atomic energy producing ministry whose activity is reported in the fuel and energy complex. *Minsviazi* is also a combined ministry. One part is related to the production of communications equipment (the former *Minpromsviazi*) and is a part of the MBMW complex; the other two components are related to business communications (productive)

and residential communications (unproductive).

To summarize, although there is an element of dispersion of the MIC activities in Soviet statistics, the bulk of military goods are not affected. They are included in MBMW production. As for the miscellaneous (*prochie*) statistical items, they take care of branches of industry other than those explicitly accounted for within major complexes (fuel and energy, metallurgical, MBMW, chemical and wood) and industries (construction materials, light, and food). Following the planning classification, the *prochie* branches of industry include the microbiological, medical and printing industries, and the production of artistic goods, jewelry, toys and the like. According to the 1989 *Narkhoz*, the combined share of all those items was more than 7% every year in the 1985-89 period.

A direct or straightforward approach to the computation of Soviet military production is based on the information on the production by the civilian MBMW ministries, which were reduced in number from 11 in 1986 to 4 in 1989. This was the result of the gradual aggregation of two or more ministries into one in the 1987-89 period. A brief history helps in understanding how different ministries' outputs are aggregated, and the effects are shown in Figure 1.

In 1987 two ministries -- the Ministry of Power Machinery (*Minenergomash*) and the Ministry of Machinery for Cattle Breeding (*Minzhivmash*) -- were eliminated. The former became a part of the Ministry of Heavy Machinery (*Mintiazhmash*), and the latter was merged into the Ministry of Agricultural Machinery (*Minsel'khoz mash*). This left 9 MBMW ministries. In 1988 the Ministry of Machinery for Light and Food Industries (*Minlegpishchemash*) was eliminated and its enterprises were transferred to the MIC (the Ministry of General Machinery and others). In addition, the Ministry of the Automobile Industry (*Minavtoprom*) and the Ministry of Agricultural Machinery (*Minsel'khoz mash*) were amalgamated into the giant Ministry

of Automobile and Agricultural Machinery (*Minavtosel'khoz mash*). This reduced the number of the civilian MBMW ministries to 7. In 1989 the Ministry of the Electrotechnical Industry (*Minelektrotekhprom*) and the Ministry of Instrument Making (*Minpribor*) were combined into the Ministry of the Electrotechnical Industry and Instrument Making (*Minelektrotekhpribor*). Two ministries -- the Ministry of Chemical Machinery (*Minkhimmash*) and the Ministry of Construction and Road Machinery (*Minstroydormash*) -- were eliminated, and their enterprises were transferred to the Ministry of Heavy Machinery (*Mintiazhmash*). There have been only 4 civilian MBMW ministries since 1989.

Table 1 gives the output of the Soviet civilian MBMW ministries in the 1985-89 period, aggregated according to the transformation discussed above. The data also reflect the creation of 5 independent industrial production associations in 1989, a new trend in Soviet economic management. Even though they are not important in terms of output statistics, the inclusion of the associations in the table guarantees that the information is complete. This is important for finding the totals. The summation in Table 1 shows the total output of the Soviet civilian MBMW ministries, which may incorporate military orders.

At the next step I will find the output of the Soviet MBMW complex and compare it with the total of the civilian ministries from Table 1. The plan is to estimate this output on the basis of the total Soviet industrial production and its breakdown by branch, as in Table 2. The percentages were taken from Soviet statistics in comparable 1982 prices, but industrial output is listed in current prices. To obtain MBMW output in current prices, its share of total industrial output has to be in current prices, too. These shares can be adjusted because there are two years when we have the percentages in current prices: 1982, for which current and

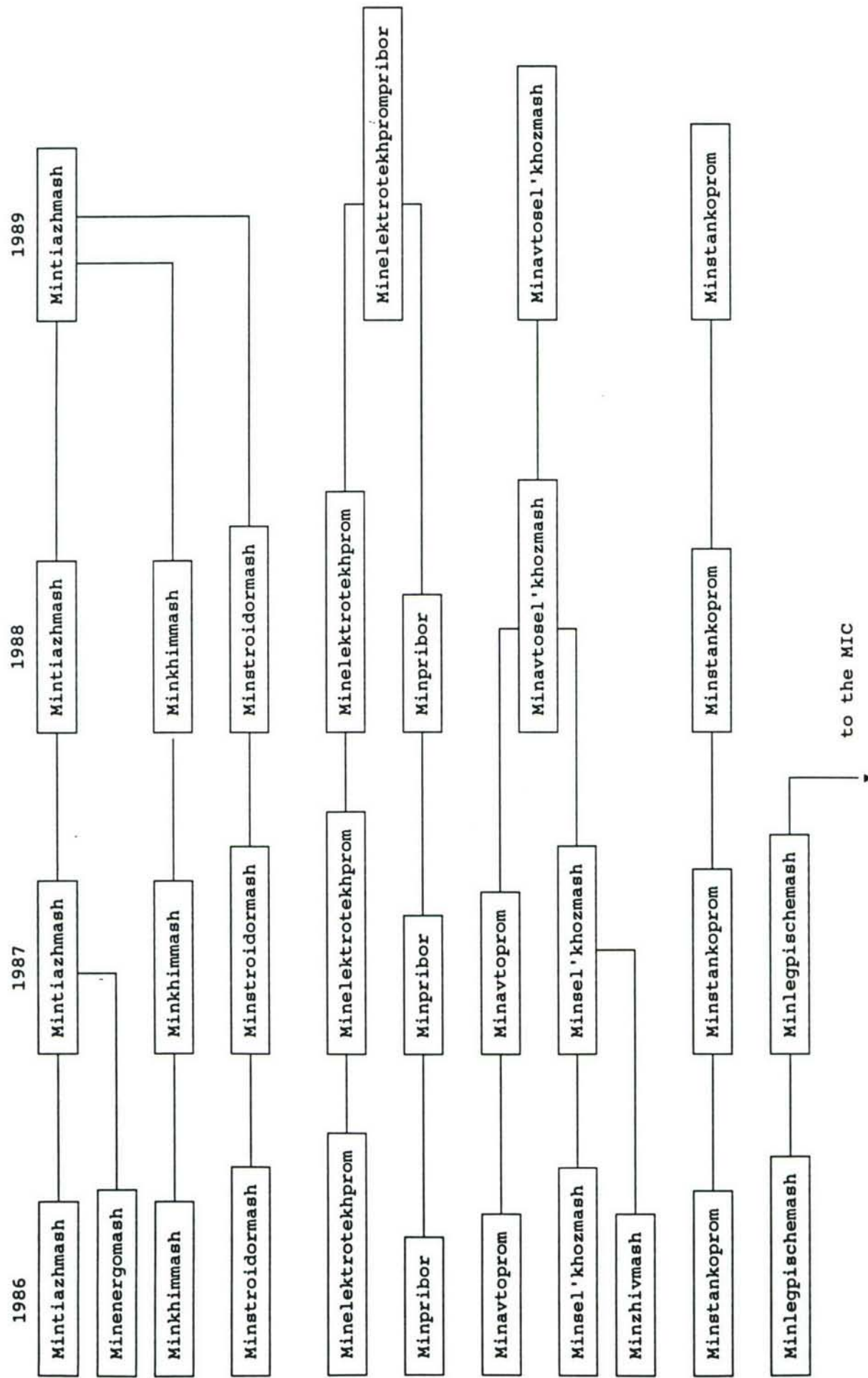


Figure 1. Transformation of Soviet Civilian MBMW Ministries in the 1986-89 Period

comparable prices are the same, and 1988, for which there is a Soviet input-output table in current prices.

Table 1. Output of Civilian MBMW Ministries in the 1985-89 Period (Billions of Rubles in Current Producers' Prices)

Ministry	1985	1986	1987	1988	1989
Mintiazhmash	6.0	6.3	9.1	9.5	19.3
Minenergomash	2.3	2.4	--	--	--
Minkhimmash	5.7	6.0	6.2	6.9	--
Minstroidormash	4.8	5.1	5.2	5.8	--
Minelektrotekhprom	14.0	15.0	15.6	16.0	--
Minpribor	5.5	6.6	7.0	7.9	--
Minelektrotekhpribor	--	--	--	--	22.4
Minavtoprom	21.6	22.6	23.6	--	--
Minsel'khosmash	13.0	13.7	17.4	--	--
Minzhivmash	3.0	3.0	--	--	--
Minavtosel'khosmash	--	--	--	42.0	42.9
Minstrankoprom	7.1	7.6	7.8	8.4	8.8
Minlegpishchemash	4.3	4.5	4.4	--	--
Kvantemp Association	--	--	--	--	0.7
Kriogenika Association	--	--	--	--	0.6
Chasprom Association	--	--	--	--	0.9
Energomash Association	--	--	--	--	1.4
Strommash Association	--	--	--	--	0.7
Total Civilian MBMW	87.3	92.8	96.3	96.5	97.7

Source: Materials of Goskomstat.

Table 2. Total Soviet Industrial Output (Billions of Rubles in Current Producers' Prices) and Industry Shares (Percent in 1982 Producers' Prices)

Indicator	1982	1983	1984	1985	1986	1987	1988	1989
Output	722	751	779	804	836	862	901	910
Breakdown								
Fuel and Energy Complex	11.9	11.6	11.5	11.3	11.1	11.1	10.8	10.5
Metallurgical Complex	NA	NA	NA	9.6	9.6	9.4	9.3	9.2
MBMW Complex	25.4	25.8	26.4	27.5	28.3	28.7	29.0	29.3
Chemical and Wood Complex	10.9	11.0	11.1	11.2	11.3	11.3	11.3	11.2
Construction Materials Industry	3.8	3.9	3.8	3.8	3.8	3.8	3.8	3.8
Light Industry	15.7	15.2	14.7	14.6	14.3	13.9	13.8	13.9
Food Industry	15.4	15.6	15.4	14.8	14.4	14.5	14.3	14.7

Sources: *Promyshlennost' SSSR*, 1988, p.7; Soviet 1988 IO Table; *Ekonomicheskaya Gazeta* 6, 1990, p.15, and *Narkhoz* 1984, p.137 and 1989, p.336.

From the input-output table, the 1988 MBMW output in current prices equals 270 b.r., and, dividing it by that year's industrial output of 901 b.r. from Table 2, the proportion is 30%. The same proportion in 1982 prices in Table 2 is equal to 29%. This discrepancy evidently occurred due to a greater rise in MBMW prices relative to the rest of the Soviet industry. To adjust the MBMW proportions for this rise in prices, I start with an unchanged 25.4% for 1982 and arrive at 30% for 1988, instead of 29% as in Table 2. The one percentage point discrepancy is split over a 6-year period from 1982 to 1988. In other words, a plausible assumption is made that the farther the proportion from 1982, the more it is affected by the price increase. The adjusted MBMW proportions in current prices are as follows: 1982, 25.4%; 1983, 26%; 1984, 26.7%; 1985, 28%; 1986, 29%; 1987, 29.5%; 1988, 30% and 1989, 30.5%.

The MBMW complex's output in current prices, estimated on the basis of those proportions, is in Table 3. It is given for 1985-89 since the output of civilian ministries from Table 1 is used in Table 3 for the computation of the military MBMW production. As Table 3 demonstrates, the ratio of total MBMW output to the output of civilian ministries was consistently rising from 2.59 in 1985 to 2.84 in 1989. The jump from 2.65 in 1987 to 2.78 in 1988 was when the enterprises of the Ministry of Light and Food Industry Machinery were shifted to the MIC. The output of the military MBMW ministries in Table 3 is the difference between the two outputs--total MBMW and its civilian ministries. This is the obvious solution. If the output of civilian MBMW ministries is less than the total for the complex, the difference

Table 3. Soviet MBMW Output, (Billions of Rubles in Current Producers' Prices)

Indicator	1985	1986	1987	1988	1989
Total MBMW Output	225	242	254	270	278
Civilian MBMW Ministries Output	87	93	96	97	98
Ratio of Total to Civilian Ministries Output	2.59	2.60	2.65	2.78	2.84
Military MBMW Ministries Output	138	149	158	173	180

Sources: Tables 1 and 2

must be the output of military ministries. This solution recognizes that military industries are classified in Soviet planning as a part of the MBMW complex. According to the industries listed above, the 6 military MBMW ministries are *Minaviaprom*, *Minobshchemash*, *Minoboronprom*,

Minradioprom, *Minelektronprom*, and *Minsudprom*. The machinery production parts of *Minsviazi* and *Minatomenergoprom* must also be included.

I will estimate military production of the ministries involved by excluding civilian production from the data in Table 3. While there is no information on civilian production by specific MIC ministries, there are official projections on the overall MIC output of civilian goods. The key number in those projections is the 1988 MIC output of civilian goods of 55 b.r. and the 1989 estimate of 60 b.r. (*Izvestiia*, Feb. 28, 1990, p.2). I will use these numbers to estimate the pre-1988 outputs. It is reasonable to assume that growth patterns of civilian production are similar for both military and civilian MBMW ministries, i.e., that, for example, an average growth for refrigerator production is the same no matter where it takes place. If so, then the civilian MBMW ministries' outputs from Table 1 could be used to find the annual growth rates. As follows from the totals in Table 1, those growth rates are: 6.3% for 1986, 3.8% for 1987 and 4.8% for 1988. They are applied to the 1988 MIC civilian output. I also take into account that those growth rates apply under "normal" conditions, but there was a jump in the MIC civilian production in 1988 due to the addition of the enterprises of the former *Minlegpishchemash* discussed above. Therefore, 4.4 b.r. (the value of *Minlegpishchemash* transferred output from Table 1) is subtracted from the 1988 output of 55 b.r., and the above percentages are applied (the 1987 output is found as $\frac{55-4.4}{1.048}$, etc.). The resulting values of civilian output are in Table 4.

Along with civilian output, Table 4 gives the estimates of military production found as the difference between the data in Table 3 and the estimated civilian production. A caveat is appropriate here. The full level of civilian output is reflected by Table 4. Obtained on the basis of Soviet official sources, this output is hardly understated. On the other hand, the military

production estimates are only for the weapons and hardware producing ministries. In other words, since the unknown outputs of non-MBMW ministries are not included, military production is understated. It therefore serves as a lower bound of the Soviet MIC military production.

Table 4. Military and Civilian Output of the Soviet MIC (Billions of Rubles in Current Producers' Prices)

Year	Military Production		Civilian Production	
	Value	Annual Growth, Percent	Value	Annual Growth, Percent
1985	95	--	43	--
1986	103	8.4	46	6.3
1987	110	6.8	48	3.8
1988	118	7.3	55	4.8
1989	120	1.7	60	9.1

Sources: Tables 1 and 3.

What part of the estimated military production is for domestic use? Although there are detailed DIA estimates of Soviet exports of conventional weapons, such estimates are not published in value terms. From different sources, the range could probably be as broad as 15 to 35% of output. I will test a hypothesis whether this interval is consistent with other available information. The hypothesis is based on the Soviets' reporting that at the outset of the conversion program civilian output had been 40% of the total. Given this and the 1989 MIC value of civilian production of 60 b.r., total MIC production would be 150 b.r. (i.e., $\frac{60}{0.4}$) and its military part 90 b.r. (i.e., 150 - 60). Why would *Gosplan* (State Planning Committee) reveal such sensitive information which contradicts the official version of military procurement?⁴ It

would not if the information is true. On the other hand, contrary to widespread accusations, *Gosplan* does not fabricate meaningless data. But, while the data have some meaning, it may not be revealed or often distorted. One of the most popular methods in the game of disinformation is dropping parts of a total which makes it impossible to restore the true picture.

How would planners usually reason when computing the proportion of civilian production in total MIC production? There are 3 components in the MIC production: military for domestic use, civilian and exported. From the public relations standpoint, the first is negative and the two others are positive, since the exports of weapons generate hard currency. A rising proportion of civilian production thus demonstrates improvement. But, with the 3 components, the proportion can be misleading. This is because even if civilian production rises and domestic consumption of weapons drops, the proportion of civilian production can decline when exports rise. My assumption is that, to make the result consistent with its purpose, *Gosplan* first subtracts the value of exports from the MIC output and *then* calculates the share of civilian production. If the hypothesis is true, the reported 40% share was of MIC output net of exports. In its tradition, *Gosplan* does not explain that this share is not what its label says.

I test the hypothesis by using the available data to find the proportion of exports of weapons and by comparing it with the "reasonable" interval considered above. The equation solved for 1989 is $0.4(180 - E) = 60$, where 180 b.r. is total military production from Table 3, E is exports of weapons and 60 b.r. is the MIC civilian production from Table 4. The equation yields exports of weapons E equal to 30 b.r. which is 25% of a 120 b.r. production of weapons from Table 4. When solved for 1988, the equation yields a 30% ratio of exports. These estimates are consistent with the indicated interval of 15 to 35%. The hypothesis thus cannot be rejected. As for annual proportions, they could vary, and additional information will be

needed to pick specific point estimates. To illustrate the methodology, a mid-interval 25% export ratio is used here; I consider this a close approximation. The resulting domestic consumption of the military output of the Soviet MIC is shown in Table 5.

Table 5. Domestic Consumption of Soviet MIC Military Output (Billions of Rubles in Current Producers' Prices)

Year	Value	Annual Growth, Percent
1985	71	--
1986	77	8.5
1987	83	7.8
1988	89	7.2
1989	90	1.1

Sources: Table 4.

Soviet domestic consumption of military output is equivalent to the MOD procurement of weapons and hardware. According to Table 5, this was growing at diminishing rates in the 1985-88 period and ceased growing in 1989. Since the output figures from Table 4 were the lower bound of estimated Soviet military production, the numbers in Table 5 would theoretically be the lower bound of Soviet military procurement. This may not be the lower bound if the export ratios are underestimated. Overall, given the high reliability of the data on the military ministries' outputs in Table 3 (on which this whole computation is built), the numbers in Table 5 must serve as a reasonable approximation of reality. For example, in 1989 Soviet military MBMW ministries produced 180 b.r. worth of goods (compare with 98 b.r. for civilian MBMW ministries). Of that amount, 120 b.r. represents pure military production. Based on production, domestic consumption of military goods was equal to 90 b.r. This is over 2.7 times the official

cost of military procurement of 33 b.r. Moreover, Soviet civilian ministries also fill some military orders.

To summarize, I first estimate output of Soviet military MBMW ministries in Table 3. It is then split into military and civilian parts in Table 4; after separating out military production, its domestic consumption is estimated in Table 5. As usual, the issue of error is crucial, and the most valuable result from this standpoint is the estimation of total output of military MBMW ministries in Table 3. As I proceed further with Tables 4 and 5, some additional assumptions are made, and the results become less reliable. Thus further inquiry is necessary.

2. Verifiable Residual Approach

The basic concept of the verifiable residual approach is based on data from the process of Soviet quality certification. In order to improve the quality of industrial goods, planners have used mandatory state certification (*attestatsiia*) according to two quality categories--high and first. For varying reasons, certain goods are exempt from certification. The proportion of goods in the high quality category is a success indicator for enterprises. Soviet statistics report this proportion twice: as a percentage of total industrial output and as a percentage of the output subject to certification. Since total industrial output is known, such reporting enables one to find output in each of the two categories--certified and non-certified. Of particular interest is the output of non-certified goods since military goods are among those. It is then clear that, if outputs of all other goods combined with the military could be estimated, the difference between the total and other goods will be the value of military production.

Table 6 gives the 2 sets of percentages in the high quality category. To apply a formula for finding the output of goods in the non-certified group, the following notation will be used:

T = total value of industrial output, R = output of goods subject to certification, N = value of output of goods in the non-certified group, H = value of output of goods in the high quality category, a = proportion of high quality category in total value of output and b = proportion of high quality category in output of goods subject to certification. Computation is based on the two proportions:

$$a = \frac{H}{T} \quad \text{and} \quad b = \frac{H}{R}.$$

Rewriting them for H and taking into account that $T = R + N$, the following equality is obtained

$$aT = b(T - N)$$

which, after solving for N yields

$$N = \left(1 - \frac{a}{b}\right)T. \tag{1}$$

Hence, the output of non-certified goods can be found given the proportions a and b from Table 6 and the total value of industrial output T from Table 2. Formula (1) permits estimating the output of non-certified goods for the years in Table 6. The table demonstrates that the value of goods in the non-certified group consistently rose in the observed period. This may reflect price inflation and changing exemptions from classification as well as changes in output.

In the 1980s the proportion of output in the high quality category was considered one of the most important indicators of industrial performance. There were several instructions for producers. The latest was the 1984 instruction issued by *Gosplan*, the State Committee on Standards (*Gosstandart*), the State Committee on Prices (*Goskomtsen*) and the State Committee on Science and Technology (*GNTK*). It was based on the 1983 resolution of the Central

Table 6. Proportion of Goods in the High Quality Category and Output of Non-Certified Goods (Billions of Rubles in Current Producers' Prices)

Year	High Quality Goods: Percent of Total Industrial Output	High Quality Goods: Percent of Output of Certified Goods	Output, Non-Certified Goods
1982	15.3	37.0	423
1983	15.8	38.8	445
1984	16.4	40.9	467
1985	16.3	44.7	511
1986	15.0	46.8	568
1987	14.0	59.2	658
1988	15.0	68.5	704
1989	10.7	NA	NA

Sources: Table 2; Narkhoz SSSR, 1982, p.123; 1983, p.131; 1985, p.106; 1986, p.136; 1987, p.91 and 1988, p.344 and materials of *Gosplan*.

Committee and Council of Ministers on the acceleration of technological change in the country. Along with outlining the terms for certification, the instruction specified the goods to be exempt from certification (Poriadok attestatsii promyshlennoi produktsii po dvum kategoriiam kachestva, *Ekonomicheskaiia Gazeta* 13, 1984, p.17):

1. Military Goods.
2. Food Products.
3. Pharmaceutical and Medical Goods.
4. Perfumes and Cosmetics.
5. Toxic Chemicals.
6. Jewelry and Crafts.
7. Publications and Art Products.
8. Unprocessed Goods.
9. Spare Parts for Goods Discontinued in Production.
10. Goods for a Factory's Own Use.
11. Other Goods according to the *Gosstandart* Specification.

The list was amended several times later. A major amendment in 1985 ended certification for light industry goods, and in 1989 the goods of the metallurgical complex, both ferrous and non-ferrous, were dropped. These changes account for the changes after 1985 shown in Table 6: declines in the high quality goods as a percentage of total output while they rose as a percentage of certified goods, and major increases in the output of non-certified goods. Generally, with the intensification of attempts at economic reform and the relaxation of the grip of central planning, mandatory product certification has lost its importance. Yet the statistics generated by the process may be helpful in the reconstruction of the scope of Soviet military production. As the list shows, there are two types of non-certified goods: (1) those confined to specific product groups and (2) those in all industrial product groups. Thus, the initial 7 items (i.e., military goods and the food products) belong to the first type. Military goods, as specified by the instruction, are used exclusively for defense purposes. The MOD also buys civilian goods, and those may be subject to certification. Thus, a regular truck bought by the MOD will be certified, while food will not. In all cases the principle applied does not depend on end users; it is the type of good that matters.

Given the value of output of non-certified goods, the plan is to estimate the values of groups listed above and to subtract them from the total in Table 6 until only the military is left. I begin with light and the food industries using the information from Table 2 and following the approach described in Section 1. The percentages of total output in current prices are estimated by using the 1982 and 1988 percentages from the Soviet input-output table. Thus, with the 1988 light industry output in current prices of 126 b.r., food industry output of 148 b.r. and total industrial output of 901 b.r., the proportions are 14.0% and 16.4%, respectively. The adjustment of proportions in 1982 prices for the increase in current prices is similar to the calculations

calculations for the MBMW proportions reported in Section 1. The adjusted proportions are in Table 7. For light industry, the percentages are similar to those in Table 2, but there is a significant adjustment for the food industry, reflecting much higher inflation of current prices. Applying the adjusted percentages to the annual values of industrial output in Table 2 yields the estimates of light and food industries production in current prices. These estimates are also in Table 7.

Several smaller non-certified product groups' outputs are estimated in Table 8. Those are pharmaceutical and medical products, perfumes and cosmetics, publications and jewelry. The composition of these items differs slightly from the list of non-certified goods where jewelry is combined with crafts, and publications with art products. The data for art products and crafts are not provided; dropping them should not lead to a meaningful error considering the low output values of such items.

Table 7. Light and Food Industries Output (Percentages of Total Output and in Billions of Rubles in Current Producers' Prices)

Year	Light Industry		Food Industry	
	Percent of Total Output	Output	Percent of Total Output	Output
1982	15.7	113	15.4	111
1983	15.2	114	16.0	120
1984	14.8	115	16.1	125
1985	14.7	118	15.9	128
1986	14.4	120	15.8	132
1987	14.1	122	16.3	141
1988	14.0	126	16.4	148
1989	14.1	128	17.2	151

Sources: Table 2 and 1988 Soviet Input-Output Table.

Among the non-certified goods that may be in any industrial product group, unprocessed goods are the biggest item. They are either intermediate products or are sold to end users without further processing. For example, in metallurgy and construction materials industry some goods, e.g., ores or gravel are considered unprocessed, while others, e.g., rolled metals or pre-fabrications are considered processed. Accurate identification of all unprocessed goods is beyond the scope of this paper. Clearly, the output of the fuel and energy complex is fully in the category of unprocessed goods.

Table 8. Outputs of Smaller Groups of Non-Certified Products (Billions of Rubles in Current Prices)

Year	Pharmaceutical and Medical Products	Perfumes and Cosmetics	Publications	Jewelry	Total
1982	3.1	3.5	3.7	3.5	13.8
1983	3.3	3.5	4.1	3.3	14.2
1984	3.5	3.6	4.3	3.0	14.4
1985	3.8	4.0	4.6	2.9	15.3
1986	4.1	4.5	4.9	3.1	16.6
1987	4.3	4.8	5.2	3.4	17.7
1988	4.6	5.3	5.6	4.2	19.7
1989	4.9	6.5	6.2	6.1	23.7

Sources: *Narkhoz* 1984, pp. 184-85; 1985, p.144; 1989, pp. 110-11, 384 and 394, and Press-Release No. 368 of Sep. 27, 1990.

As in the case of light and the food industries, the 1982 and the 1988 proportions of total output in current prices are used to estimate the output of the complex. The adjusted proportions in current prices are in Table 9, as is the output of the fuel and energy complex obtained by applying the adjusted proportions to Soviet industrial output from Table 2.

There are other items on the list of non-certified products, such as spare parts for goods discontinued in production and goods for a factory's own use. Spare parts are the product of the MBMW complex. They are in the value of all non-certified MBMW goods reported in Table 10. The advantage of this approach, as compared to separate estimates, is that all reasons for exempting MBMW goods from certification are accounted for in Table 10. For example, the bulk of non-certified MBMW products would fall into a category with the vague name of "other goods exempt from certification according to *Gosstandart* specification" which is included in the Table 10 estimates.

Table 9. Adjusted Fuel and Energy Complex (Percentages of Total Output and in Billions of Rubles in Current Producers' Prices)

Year	Percent of Total Output	Output
1982	11.9	86
1983	11.7	88
1984	11.6	90
1985	11.5	92
1986	11.3	94
1987	11.4	98
1988	11.1	100
1989	10.9	99

Sources: Table 2 and 1988 Soviet Input-Output Table.

Table 10 lists the output of non-certified goods by ministry and for the civilian MBMW as a whole. The computation is based on proportions provided by *Goskomstat* and the ministries' output from Table 1. The classification of ministries also corresponds to Table 1. Table 10 shows that the output of non-certified civilian MBMW goods rose from almost 30 b.r.

to over 53 b.r. in 1989. This happened both due to the overall industrial growth and a gradual decline in the proportion of certified goods. What goods does Table 10 cover? Since the civilian ministries are listed, it is logical to presume that the goods are also civilian. Yet, taking Soviet realities into account, the presumption is wrong. As noted above, some Soviet civilian ministries often produce military goods, especially *Minkhimmash*, *Minstroydormash*, *Minpribor* and *Minelektrotekhprom*. For this reason, some goods in Table 10 are military, and the estimate that targets the MIC ministries will serve as a lower boundary of any estimate of Soviet military production.

As noted, non-certified types of goods are either confined to specific industries or could be a part of any industry. Estimates of the latter type (unprocessed goods, spare parts for discontinued goods, goods for a factory's own use, and other goods according to *Gosstandart* specification) are difficult. While the information for the MBMW ministries in Table 10 includes all non-certified goods regardless of the reason, there is no such aggregate information for other industrial ministries. To get down to specific annual estimates of Soviet military production, additional information for other industrial complexes will be needed. This is especially true for the metallurgical and chemical and wood complexes where non-certified unprocessed goods are to be identified and estimated. The resulting omissions rise after 1985 with more exemptions from certification.

Once all the detailed information on certification is taken into account, the estimates here must be close to those for the Soviet MIC in Table 4. How close are they for 1985 when the potential discrepancy was at a minimum? Table 11 shows the unexplained difference of 128 b.r. between the two totals--all non-certified industrial goods and non-certified civilian goods. This

Table 10. Non-Certified Goods of Civilian MBMW Ministries (Percentages of Total Output and in Billions of Rubles in Current Producers' Prices)

Ministry	1985		1986		1987		1988		1989	
	Percent of Total Output	Value	Percent of Total Output	Value	Percent of Total Output	Value	Percent of Total Output	Value	Percent of Total Output	Value
Mintiazhmash	39.8	2.4	43.2	2.7	49.2	4.5	50.8	4.8	54.3	10.5
Minenergomash	51.3	1.2	59.8	1.4	--	--	--	--	--	--
Minkhimmash	37.6	2.1	36.6	2.2	43.4	2.7	51.9	3.6	--	--
Minstroidormash	21.7	1.0	35.5	1.8	37.3	1.9	44.1	2.6	--	--
Minelektrottekhprom	29.0	4.1	29.7	4.5	33.2	5.2	36.7	5.9	--	--
Minpribor	28.7	1.6	39.2	2.6	43.6	3.1	52.2	4.1	--	--
Minelektrotekhpribor	--	--	--	--	--	--	--	--	44.8	10.0
Minavtoprom	32.9	7.1	36.4	8.2	50.4	11.9	--	--	--	--
Minsel'khoz mash	41.2	5.4	39.7	5.4	45.6	7.9	--	--	--	--
Minzhivmash	20.3	1.4	22.0	1.5	--	--	--	--	--	--
Minavtosel'khoz mash	--	--	--	--	--	--	53.4	22.4	60.2	25.8
Minstrankoprom	27.1	1.9	32.4	2.5	42.6	3.3	46.5	3.9	49.6	4.4
Minlegpishchemash	29.9	1.3	34.2	1.5	39.3	1.7	--	--	--	--
Kvantemp Association	--	--	--	--	--	--	--	--	80.2	0.6
Kriogenika Association	--	--	--	--	--	--	--	--	66.8	0.4
Chasprom Association	--	--	--	--	--	--	--	--	34.4	0.3
Energomash Association	--	--	--	--	--	--	--	--	65.6	0.9
Strommash Association	--	--	--	--	--	--	--	--	54.4	0.4
Total Civilian MBMW	33.8	29.5	37.0	34.3	43.8	42.2	49.0	47.3	54.6	53.3

should conditionally be identified with military production. The 1985 MIC military production from Table 4 equals 95 b.r. which was assumed to be the lower bound. The gap between the two estimates is 33 b.r., but both are much higher than official estimates of military production.

Table 11. Output of Different Groups of Non-Certified Goods in 1985 (Billions of Rubles in Current Producers' Prices)

Product Group	Output
Light Industry Goods	118
Food Industry Goods	128
Fuel and Energy	92
Civilian MBMW	30
Miscellaneous Group of Products	15
Total for the Group	383
Total Output of Industrial Non-Certified Goods	511
Difference between the Totals	128

Sources: Tables 6, 7, 8, 9 and 10

The convergence of these two estimates will be achieved when additional non-certified goods are taken into account in Table 11 and when civilian production in Table 4 is estimated more accurately. But, if the estimate in Table 4 need not be corrected much, the key to convergence will then be in verifying the items excluded from the certification of product quality. Then it may be possible to obtain reliable estimates of Soviet military production.

Conclusion

This paper deals with Soviet military production and procurement, the greatest item of their military expenditure. When a country rapidly disintegrates and no longer presents a threat, its military expenditure loses some of its original significance. On the other hand, the credibility of leadership is also important when there are requests for economic aid from nations unwilling to support the Soviet military. After years of lying, are the new Soviet leaders revealing or ready to reveal the truth about military spending?

Two methods to check this are suggested in the paper. The first method employs direct accounting to find the output of the Soviet military industrial complex (MIC). Based on reliable information on the production of civilian machine-building and metalworking (MWBW) ministries, this output estimate can in turn serve as a point of departure for any specific inquiries into Soviet military production. The calculation shows the MIC output as a part of the MBMW complex. The production estimate for the MIC is then split into civilian and military components. And, finally, military procurement (or domestic consumption of weapons) is computed by subtracting the estimated export of weapons.

The second method uses statistics from the process of product quality certification to estimate the output of a group of non-certification goods that includes military goods. The approach then involves identification of items other than military and subtracting their output from the group's total. Identification of the different non-certified goods is a tedious task, and what is accomplished in the paper in this respect needs to be further refined. Soviet economists looking for ways to estimate their military production may be in a better position to do this. As a matter of fact, a purpose of this paper is to offer the methodology to Soviet colleagues and to seek their help in accounting for all goods that are exempt from certification in Soviet industry.

Once the computation is complete, the method becomes verifiable since military production is found by explicitly accounting for all product groups produced in the Soviet economy, both certified and non-certified.

Although, at this stage, there is a gap in the results produced by the two methods, both estimates are close to three times the official figures of military procurement.

Notes

1. For the methodology of estimation of Soviet military production within the GNP accounts see Dimitri Steinberg, "Estimating Total Soviet Military Expenditures: An Alternative Approach Based on Reconstructed Soviet National Accounts," in Jacobsen, ed., *The Soviet Defense Enigma* (Oxford: Oxford University Press, 1987). One of the first comprehensive estimations within the MBMW complex has been done by William T. Lee, *The Estimation of Soviet Defense Expenditures, 1955-75* (N.Y.: Praeger Publishers, 1979).

2. I. Birman, "The Size of Soviet Military Expenditure, Methodological Aspect," p.21 (Russian version).

3. The Soviets have never made secrets of this affiliation. As a matter of fact, one can check with any issue of *Metodicheskie ukazaniia k sostavleniiu gosudarstvennogo plana narodnogo khoziaistva SSSR*.

4. Although in a desperate attempt at survival *Gosplan* changed its name in 1991, I will use here the convenient old name.

COMMENTS BY 0PDUSD(S&R)/SOVIET & EASTERN EUROPEAN AFFAIRS

With the dissolution of the USSR and formation of 12 independent states, paper is already dated. Suggest that the introduction address this problem and explain how the proposed methodology may still be applicable.

Comments--Fyodor I. Kushnirsky Paper on
Estimating Soviet Military Production

1. ODB-1 analysts take exception to the factual treatment of data in Kushnirsky's paper.
2. Industrial prices are used incorrectly in the Direct Residual Approach and the Verifiable Residual Approach, rendering the resulting analysis misleading. The value for industrial production used in Table 2 (page 9) and throughout the assessment are flawed because they include significant double counting of industrial production; that is, they measure what is called the **gross value of output**. In simple terms this means that the value of components that go into producing a product are counted at least twice. The more complicated the final product (i.e. the more plants that are involved in supplying components) the more the double counting.

Example. A plant produces an aircraft engine valued at 50,000 rubles. A second plant assembles the aircraft which is valued at 1,000,000 rubles. Under gross value of output accounting, the value of both plants are aggregated (1,050,000 rubles) despite the fact that the engine is a component of the final aircraft and already counted in the value of the final aircraft.

3. The existence of the problem can be seen simply by comparing the values used for industrial production in Table 2 and the values of overall gross national product (GNP), which contains no double counting, for the same years. Industrial production, which is a component of GNP, cannot be larger than GNP itself, yet it is these industrial production values that are used in the assessment.

	(In billions of current rubles)				
	1985	1986	1987	1988	1989
Soviet Industrial Output (from Table 2)	804	836	862	901	910
Soviet Gross National Product (from the Soviet Statistical Yearbook)	777	799	825	875	924

4. Because the Direct Residual Approach uses inflated values for industrial production and then applies percentage shares to this inflated total to establish the value of defense production, defense production likewise is inflated. In sum, the estimate shown in Table 3 (page 10) for the value of Military MBMW Ministries Output is inflated due to the use of flawed (double counting) Soviet gross value of output statistics for industrial production. Likewise, the values estimated for military production in Table 4 (page 12) also are overstated.

5. In a question on page 12 the author asks after having shown that his approach using available Soviet economic data depicts a value of military production much higher than claimed in the official defense budget, "Why would Gosplan (State Planning Committee) reveal such sensitive information which contradicts the official version of military procurement?". The author speculates the Soviets did some creative accounting with weapons exports. DIA maintain that the author simply derived estimates in flawed gross value of output statistics whereas the Soviet defense budget is adjusted to remove the double counting inherent in gross value of output statistics. Were he to adjust for the double counting, he would find that the data he has manipulated is largely consistent with the Soviet defense budget, and therefore he has in reality not deciphered any startling anomalies in Soviet defense-related economic data.

6. On page 13, the author proceeds with a "hypothesis" on the value of weapons exports to support his Direct Residual Approach to estimating weapons production. The author derives a residual for the value of weapons exports of 30 billion rubles for 1989 and determines this to be "reasonable" and states "the hypothesis thus cannot be rejected." Again, because of the double counting inherent in the data used, these residuals are too large. This can be shown by information on the value of Soviet weapons exports contained in an interview with then-Chief of the Military Industrial Commission of the USSR Council of Ministers Igor Belousov in the January 1991 edition (No.2) of the Soviet government newspaper Pravitelstvennyy Vestnik. Belousov claimed that arms exports in 1990 totaled only 9.7 billion rubles and that the value for the whole 1986-90 period was only 56.7. Once double counting is removed from Soviet statistics, Belousov's export values can be shown to be largely consistent with Soviet official defense budget data.